EGSIEM

European Gravity Service for Improved Emergency Management

European Gravity Service for Improved Emergency Management - Status and project highlights

Torsten Mayer-Guerr, Jäggi Adrian, Ulrich Meyer, Yoomin Jean, Andreja Susnik, Matthias Weigelt, Tonie van Dam, Frank Flechtner, Christian Gruber, Andreas Güntner, Ben Gouweleeuw, Andreas Kvas, Beate Klinger, Jakob Flury, Sean Bruinsma, Jean-Michel Lemoine, Hendrik Zwenzner, Stephane Bourgogne, and Tamara Bandikova

EGU General Assembly 2016

Vienna, April 20th

EOSIEM

European Gravity Service for Improved Emergency Management

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LANTMÄTERIET

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
JOINT RESEARCH CENTRE
Directorate H - Institute for Environment and Sustainability
Climate Risk Management

IAG GGOS

TECHNISCHE UNIVERSITÄT MÜNCHEN

THE UNIVERSITY OF TEXAS AT AUSTIN

universitätbonn igg

EUROPEAN GEOSCIENCES UNION

UNIVERSITÄT BERN

UNIVERSITÉ DU LUXEMBOURG

GFZ Helmholtz Centre Potsdam

TU Graz Graz University of Technology

Leibniz Universität Hannover

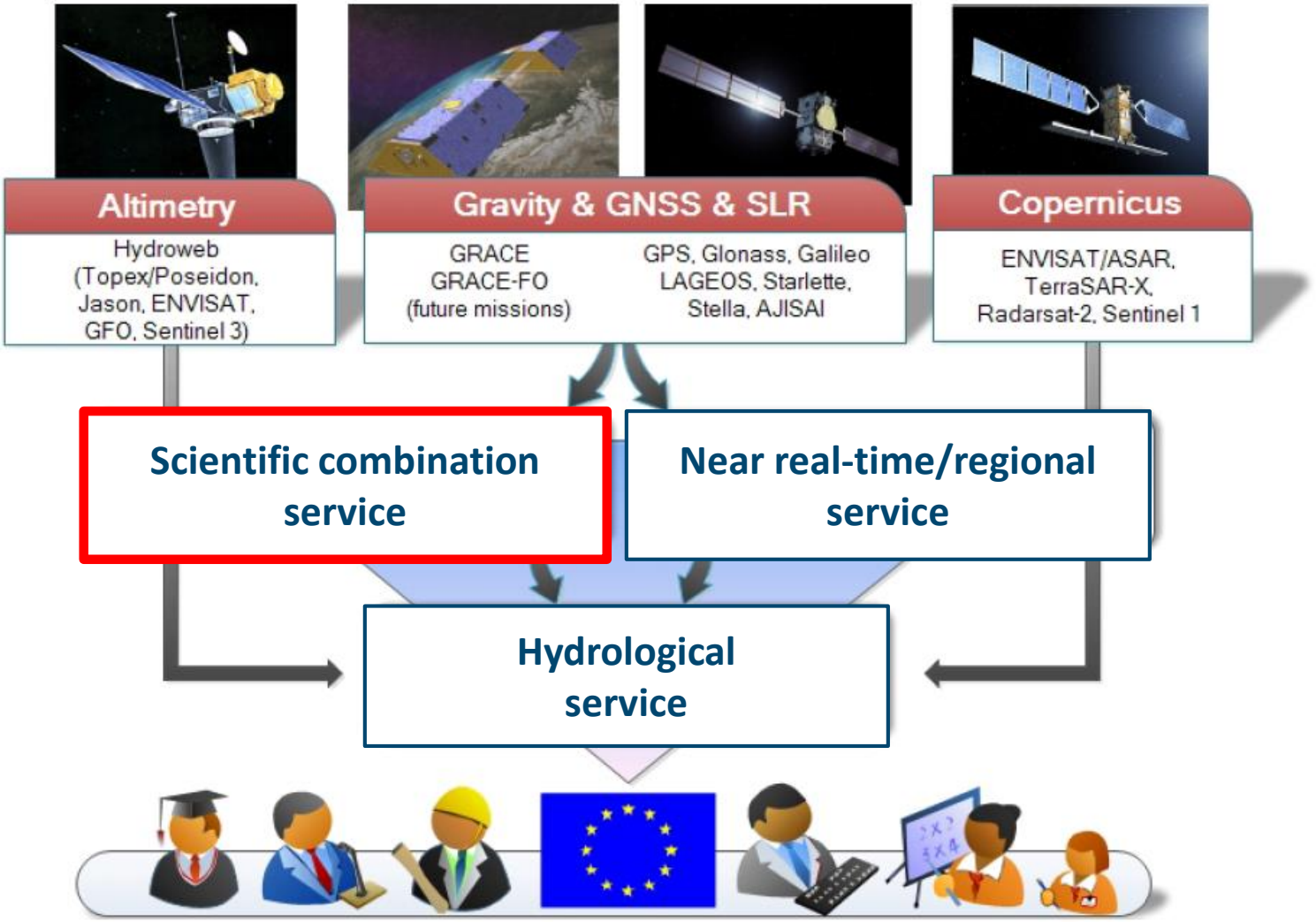
cnes

DLR

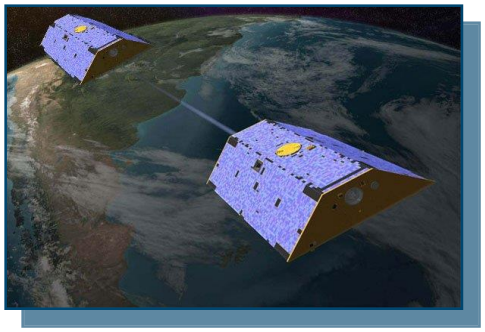
géode&cie

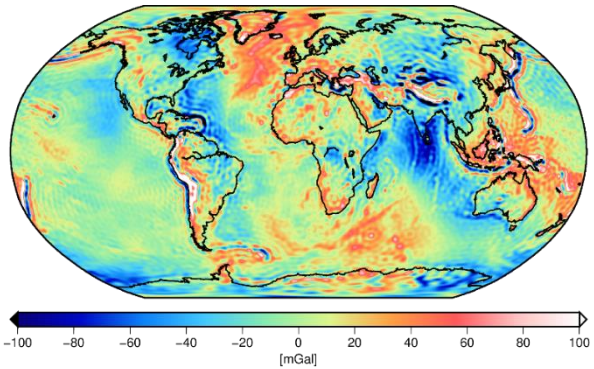
Horizon2020

EGSIEM Project - Three services shall be established



Scientific service





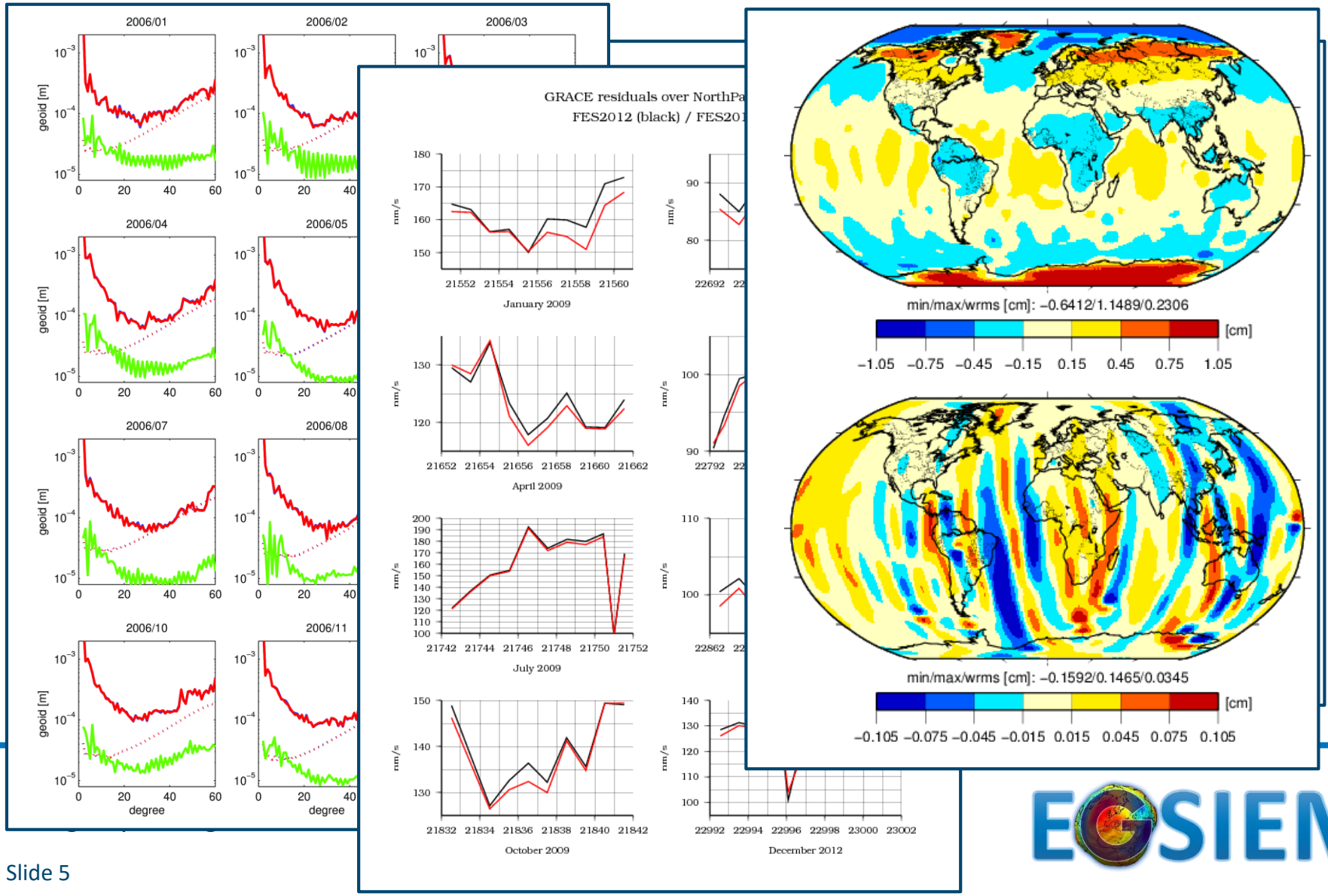
EGSIEM Analysis Centers (ACs):

- **GFZ**
- **CNES**
- **AIUB**
- **TUG - ITSG**
- **University of Luxembourg**
- More in the future …

1. Improvements of the processing
2. Integration of complementary data
3. Harmonization of processing standards
4. Combination of the solutions

1. Improvements of the processing

A lot of tests, comparisons, discussions: instruments, calibration, background models



1. Improvements of the processing

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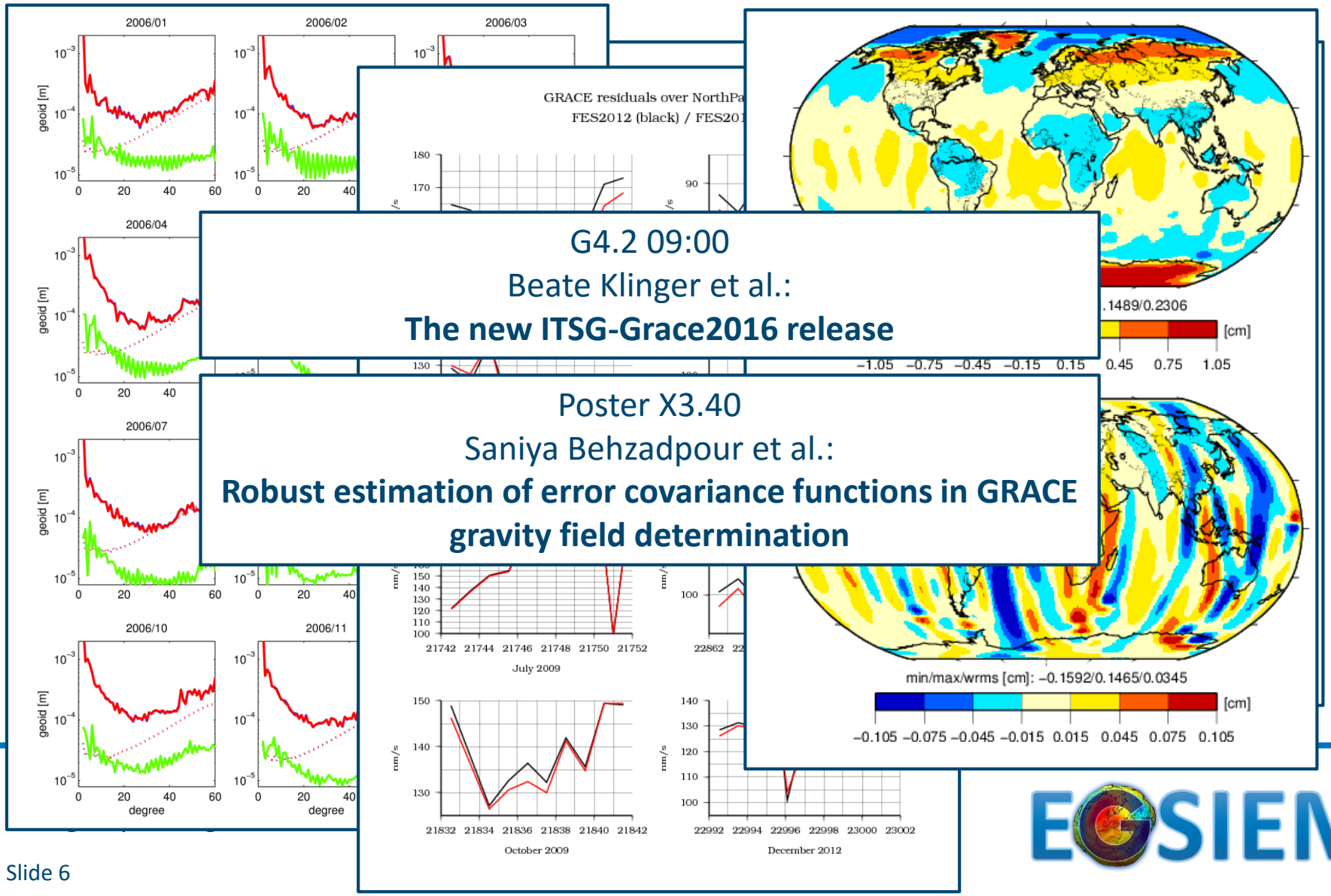


G4.2 09:00

Beate Klinger et al.:

The new ITSG-Grace2016 release

Poster X3.40

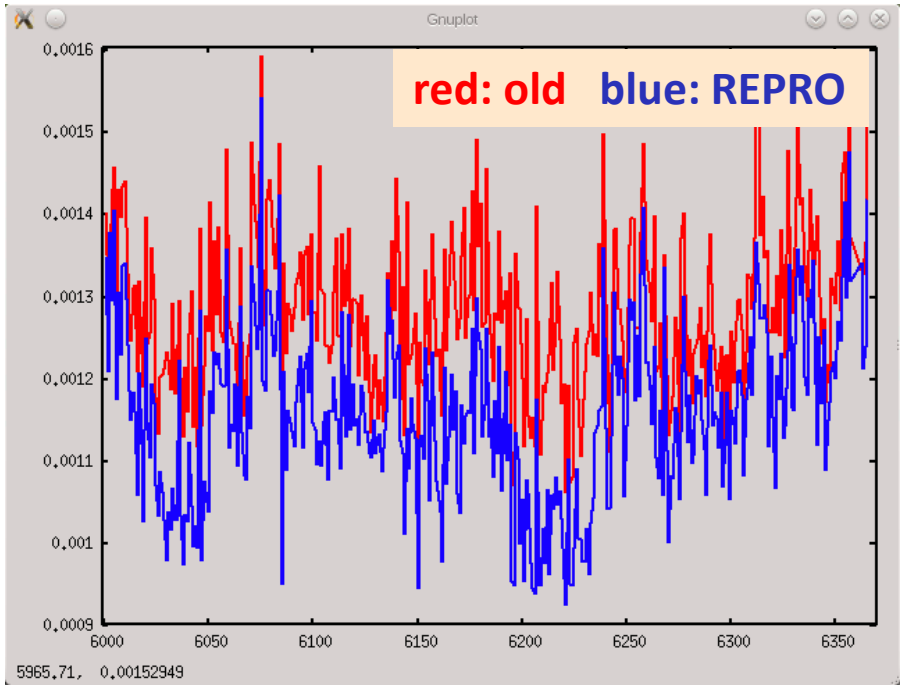
Saniya Behzadpour et al.:

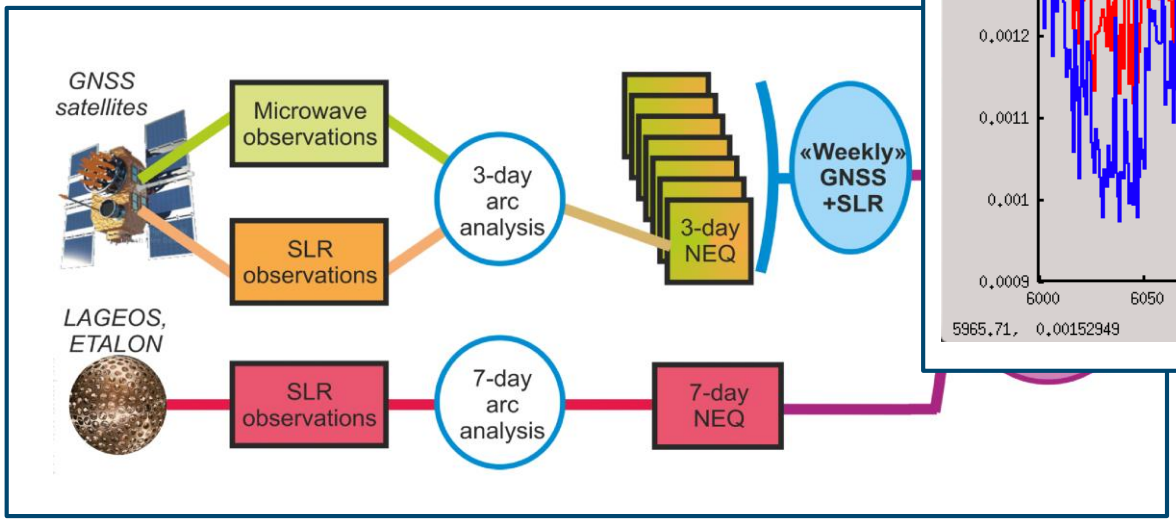
Robust estimation of error covariance functions in GRACE gravity field determination

2. Integration of complementary data

- Reprocessed GPS orbits and clock corrections
- SLR for low degree gravity field
- POD from non-dedicated satellites

Kinematic orbits





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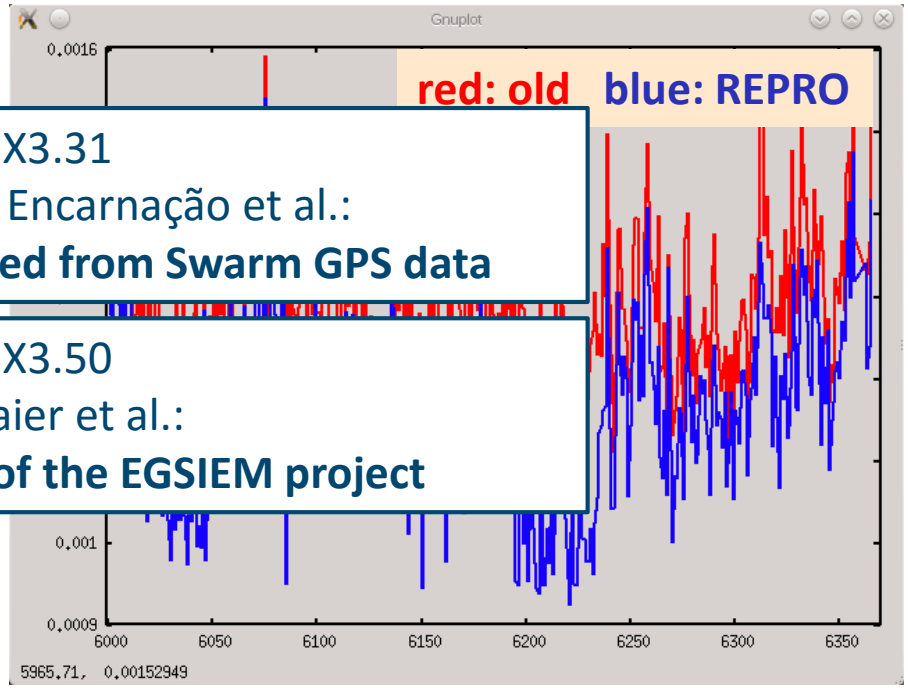

Poster X3.31
João de Teixeira da Encarnação et al.:
Gravity field models derived from Swarm GPS data

Poster X3.50
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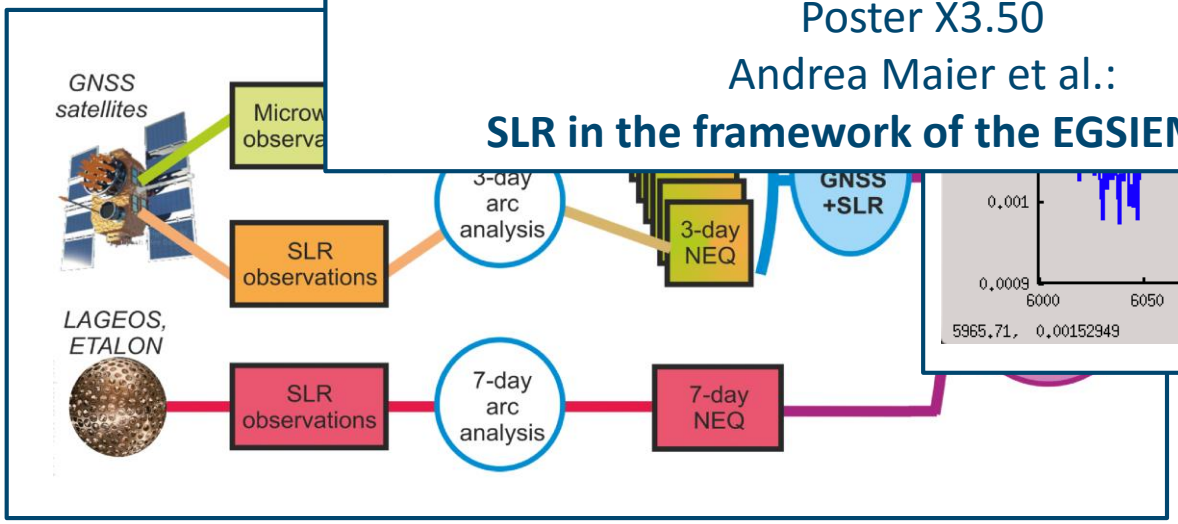
SLR in the framework of the EGSIEM project



3. Harmonization of processing standards

- Common reference frame and GPS orbit constellation
- Ensemble of different background models
- Distribution of solutions at normal equation level in standard SINEX format

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+FILE/COMMENT
+SOLUTION/STATISTICS
+SOLUTION/NORMAL_EQUATION_VECTOR
+SOLUTION/NORMAL_EQUATION_MATRIX U
+SOLUTION/ESTIMATE
+SOLUTION/APRIORI
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EGSIEM

European Gravity Service for Improved Emergency Management

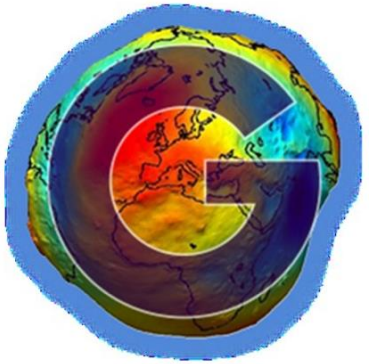
HORIZON 2020

EO-1-2014: New ideas for Earth-relevant space applications
Research and Innoation Action

Action Acronym:	**EGSIEM**
Action full title:	European Gravity Service for improved Emergency Management
Grant agreement no:	637010

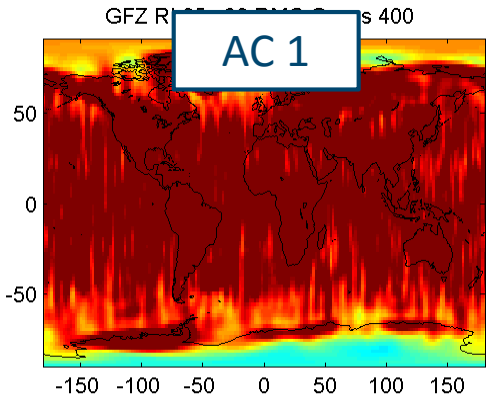
Deliverable 2.1:
Processing Standards

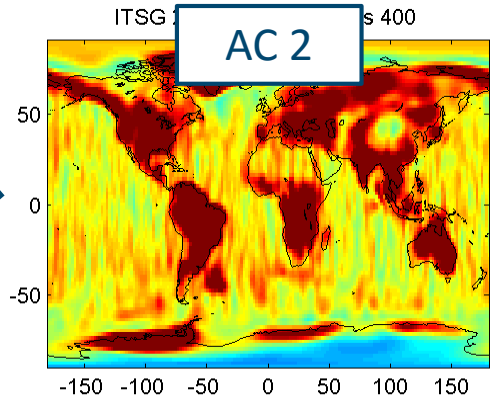
Date: 02/03/2015

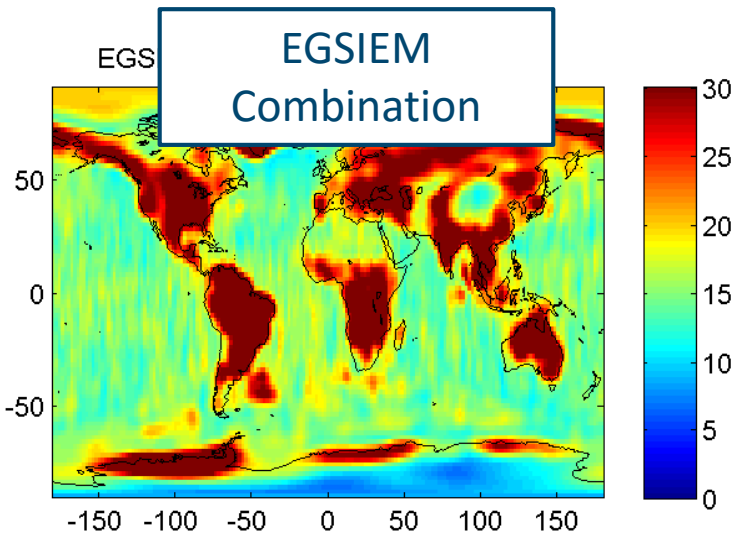


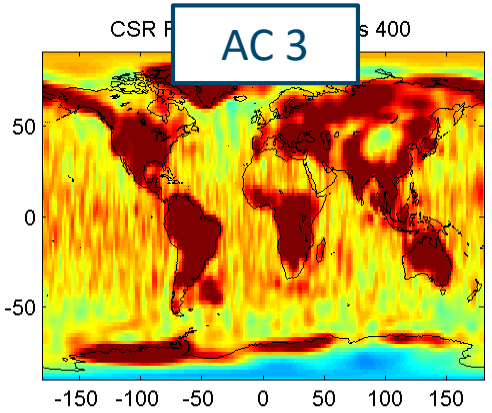
Prepared by: U. Meyer

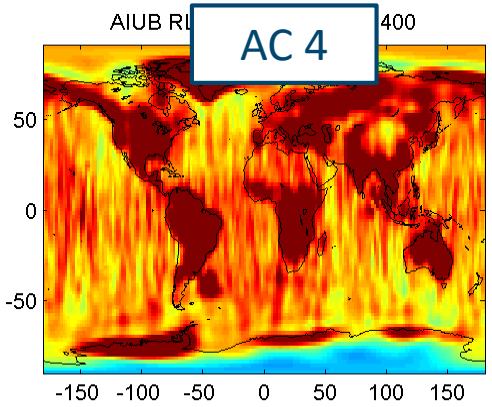
4. Combination of the solutions





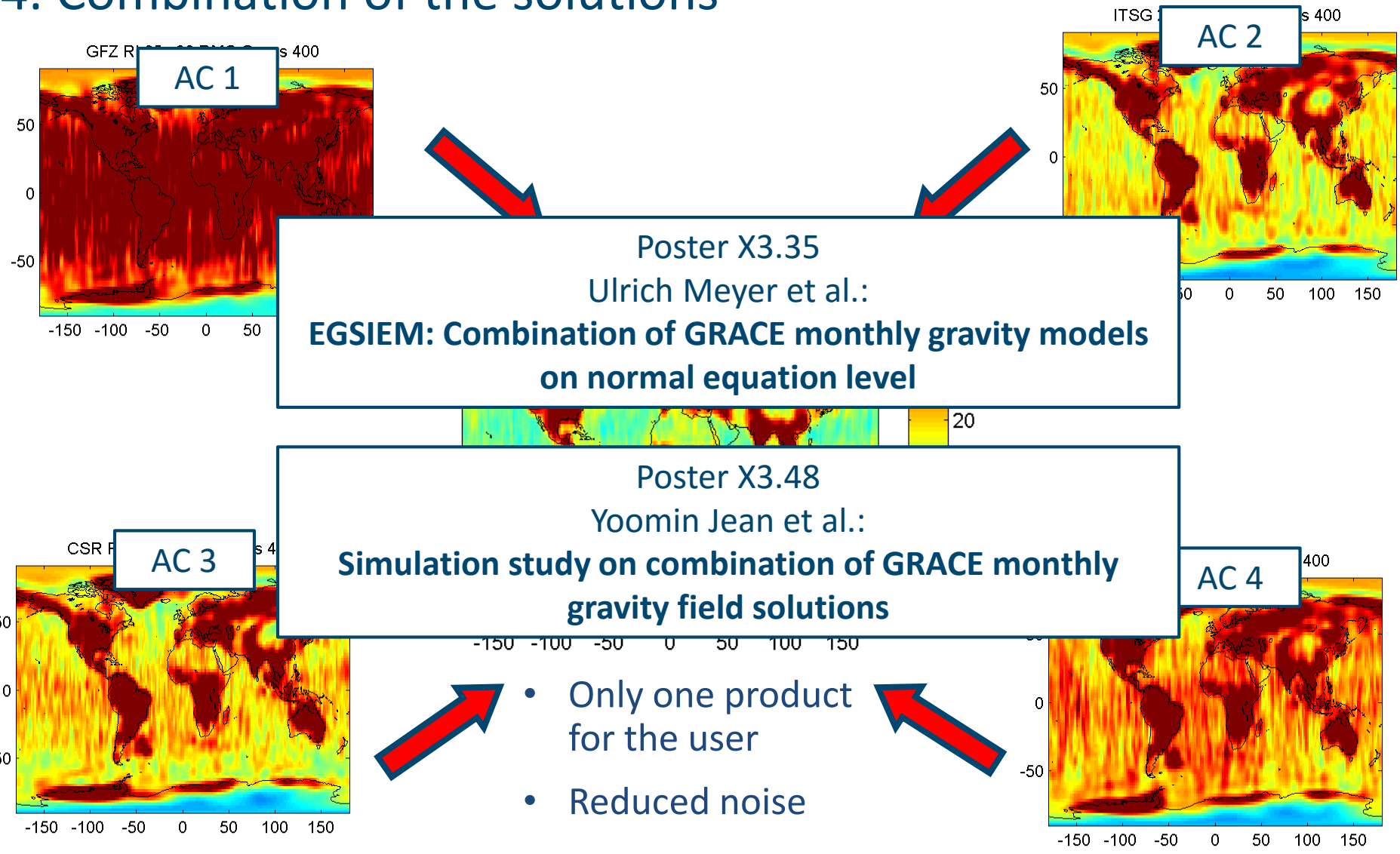




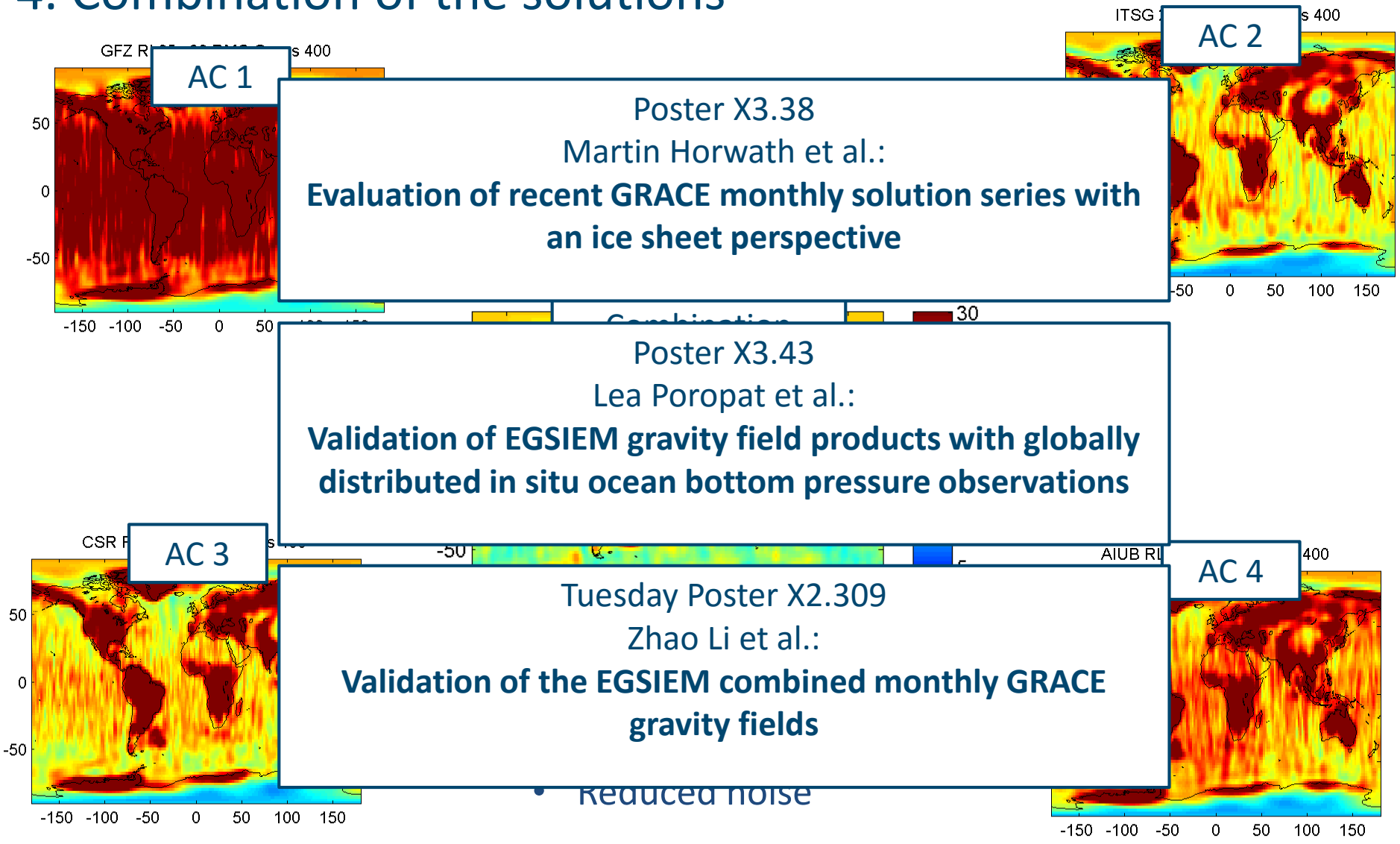


- Only one product for the user
- Reduced noise

4. Combination of the solutions



4. Combination of the solutions



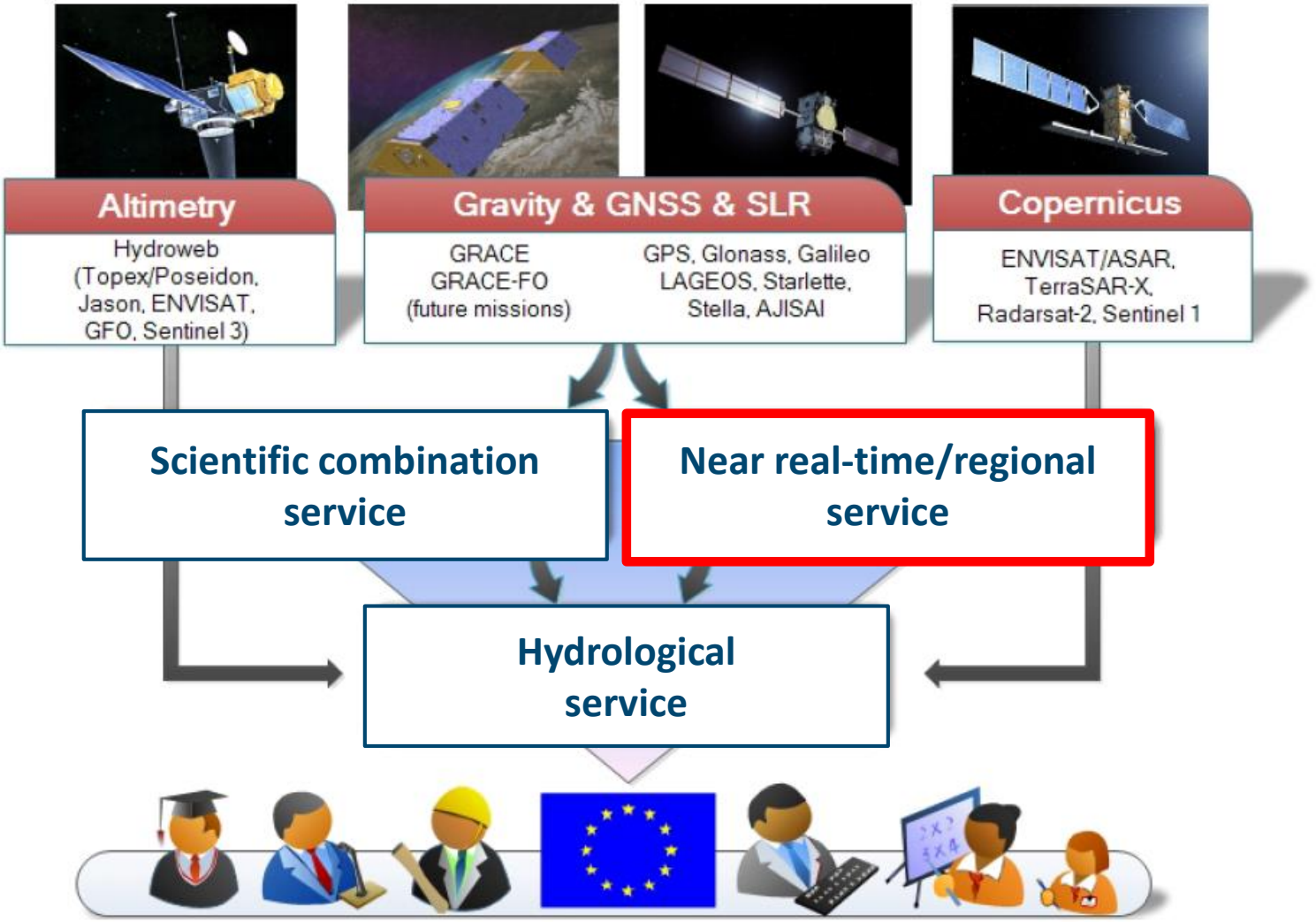
Poster X3.38
Martin Horwath et al.:
Evaluation of recent GRACE monthly solution series with an ice sheet perspective

Poster X3.43
Lea Poropat et al.:
Validation of EGSIEM gravity field products with globally distributed in situ ocean bottom pressure observations

Tuesday Poster X2.309
Zhao Li et al.:
Validation of the EGSIEM combined monthly GRACE gravity fields

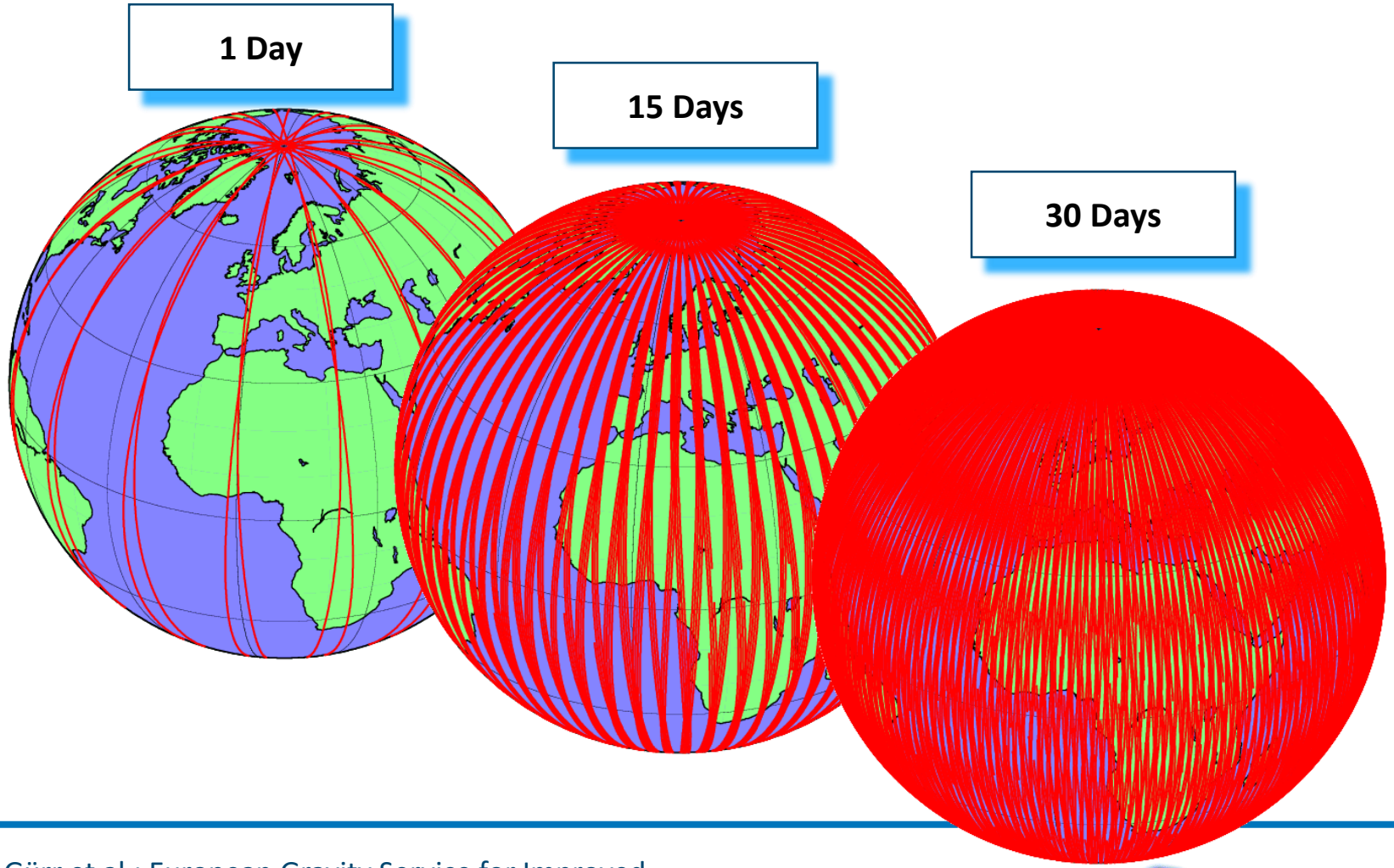
- Reduced noise

EGSIEM Project



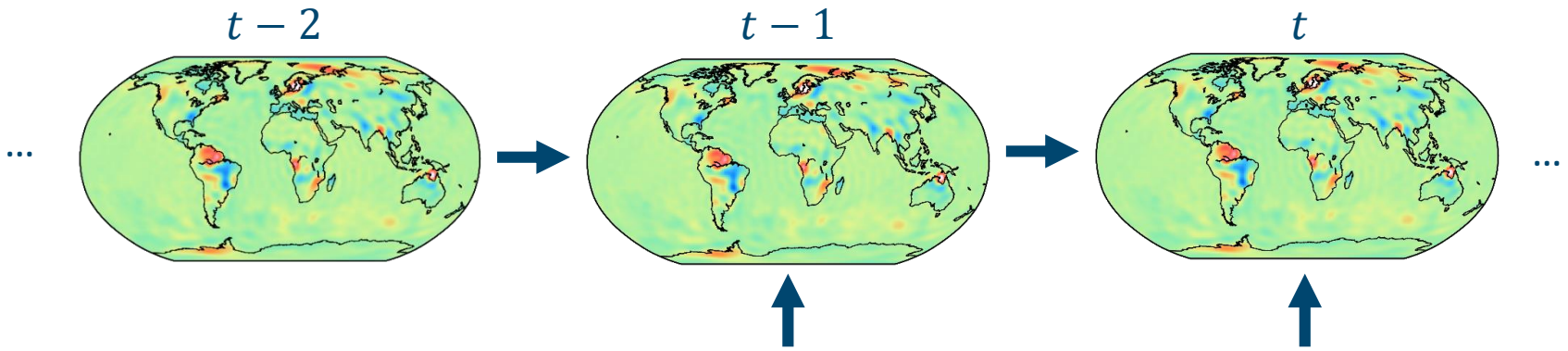
Daily updated gravity field solutions from GRACE

- Data distribution is a challenge



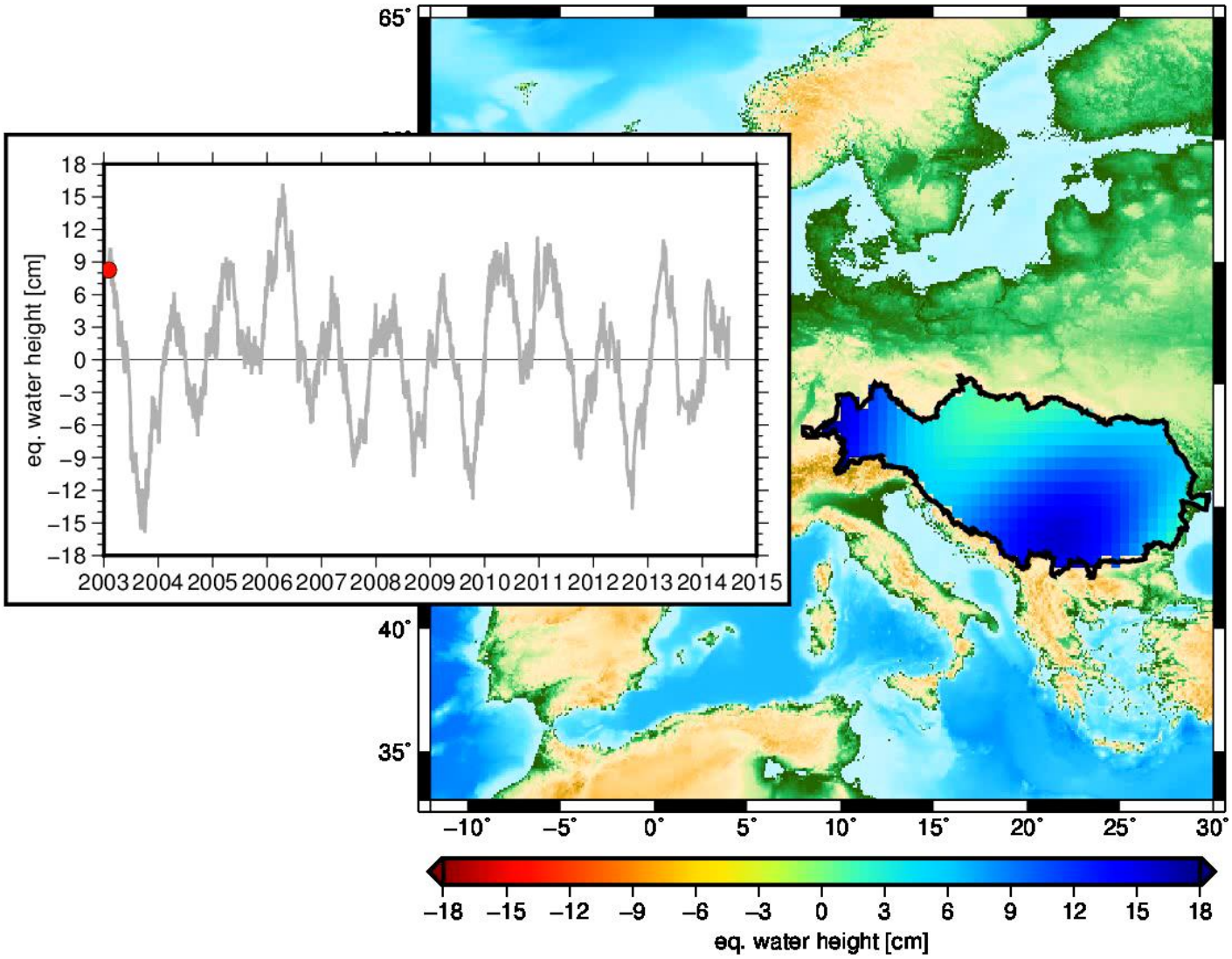
Daily updated gravity field solutions from GRACE

- Data distribution is a challenge
- Additional information is introduced in form of a **process model**
  - Prediction based on spatio-temporal correlations from geophysical models
  - Solution is weighted mean between GRACE observations and prediction



GRACE Kalman Filter
(Kurtenbach et al. 2012)

Example: The Danube basin



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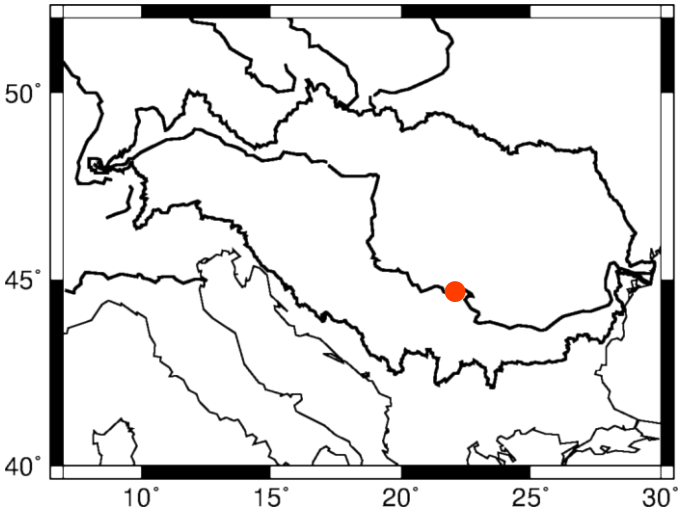
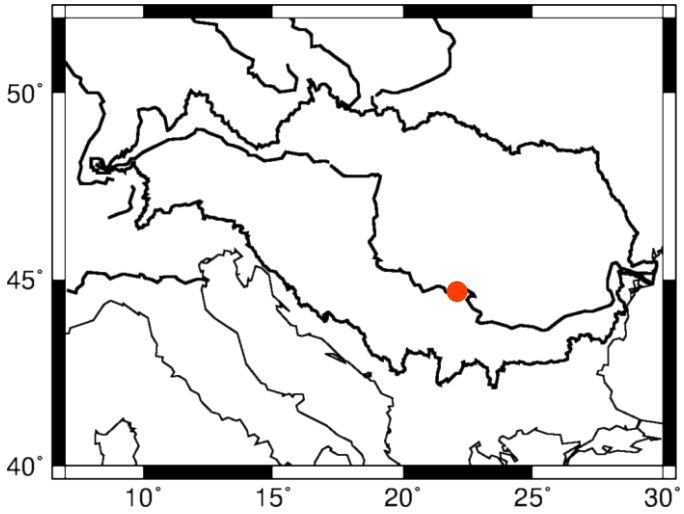


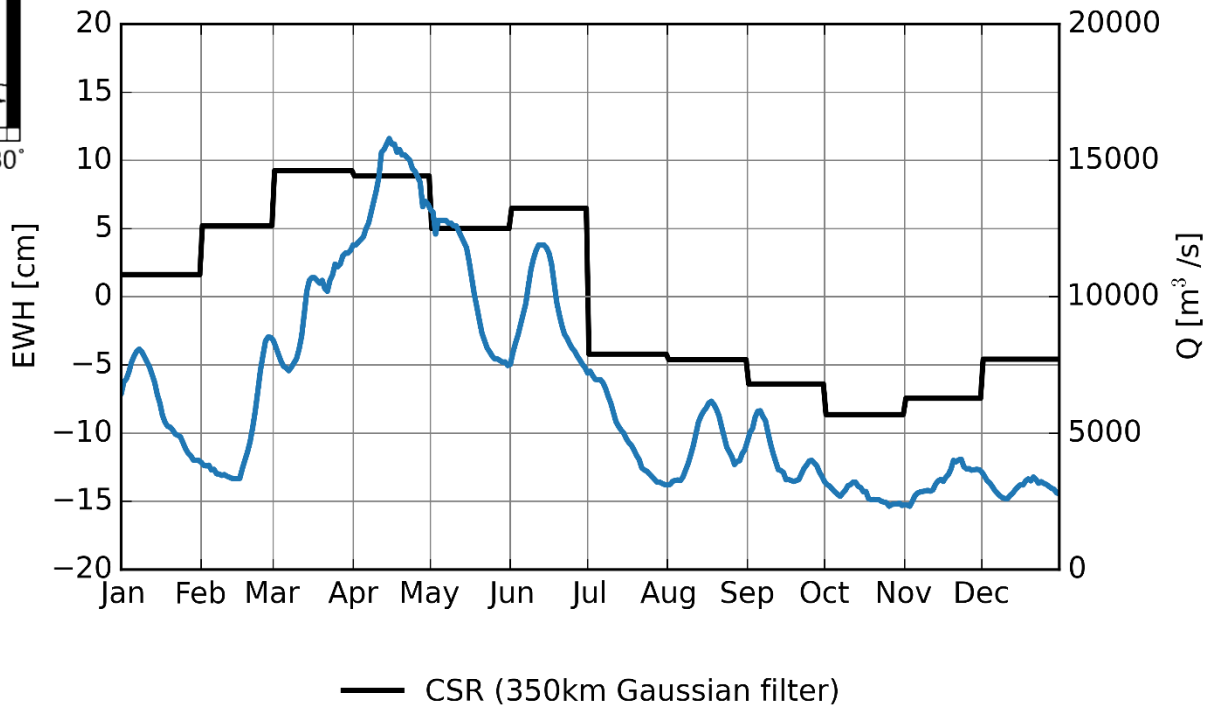
River discharge at Bazias, 2006

Example: The Danube basin



Water storage:
GRACE monthly solutions

River discharge at Bazias, 2006



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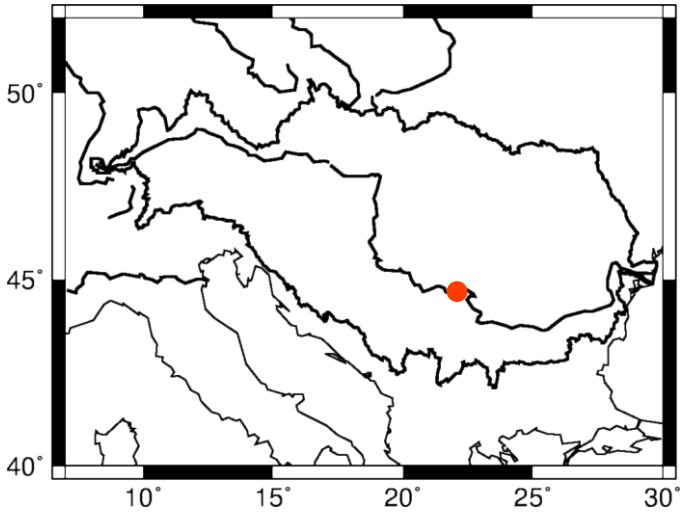
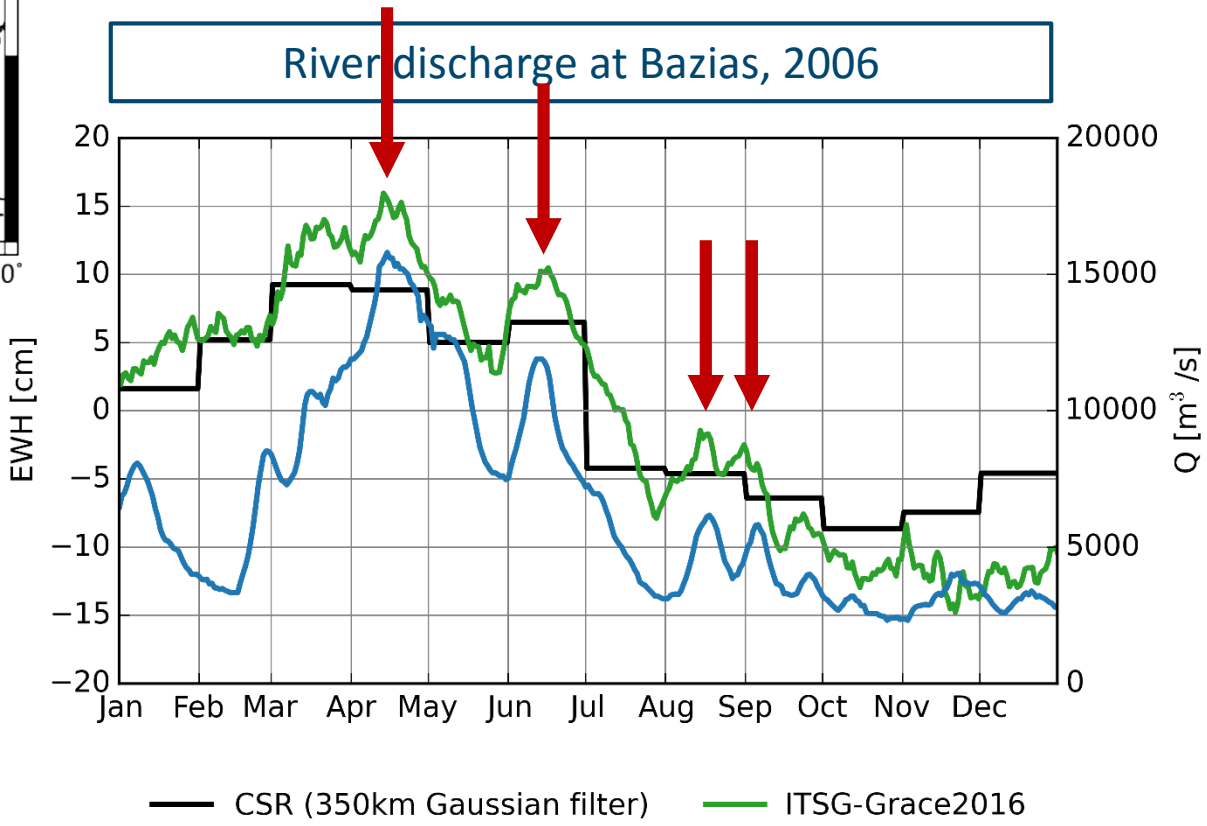


Water storage:
GRACE monthly solutions

Daily Kalman solutions



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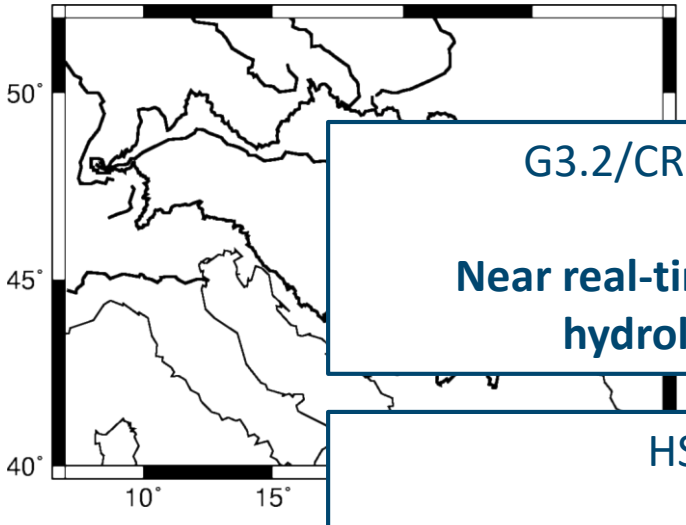
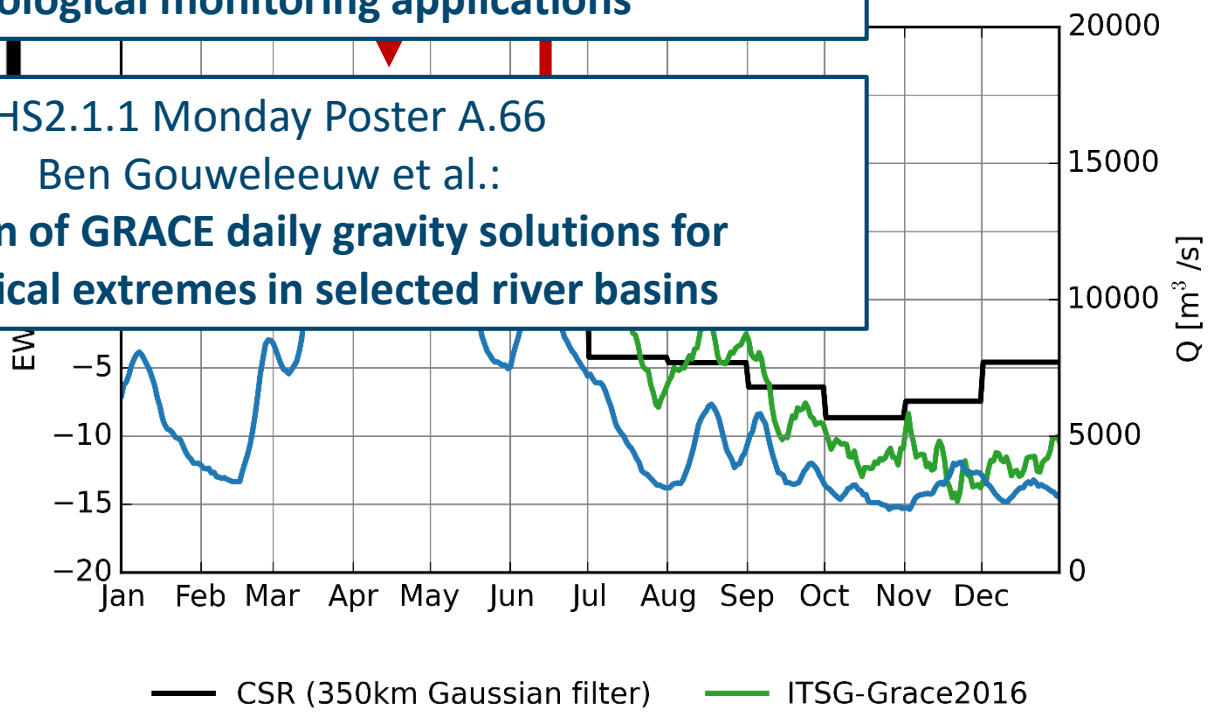


G3.2/CR2.4/HS11.7/OS4.9 Monday 14:30
Andreas Kvas et al.:
Near real-time GRACE gravity field solutions for hydrological monitoring applications

HS2.1.1 Monday Poster A.66
Ben Gouweleeuw et al.:
Evaluation of GRACE daily gravity solutions for hydrological extremes in selected river basins

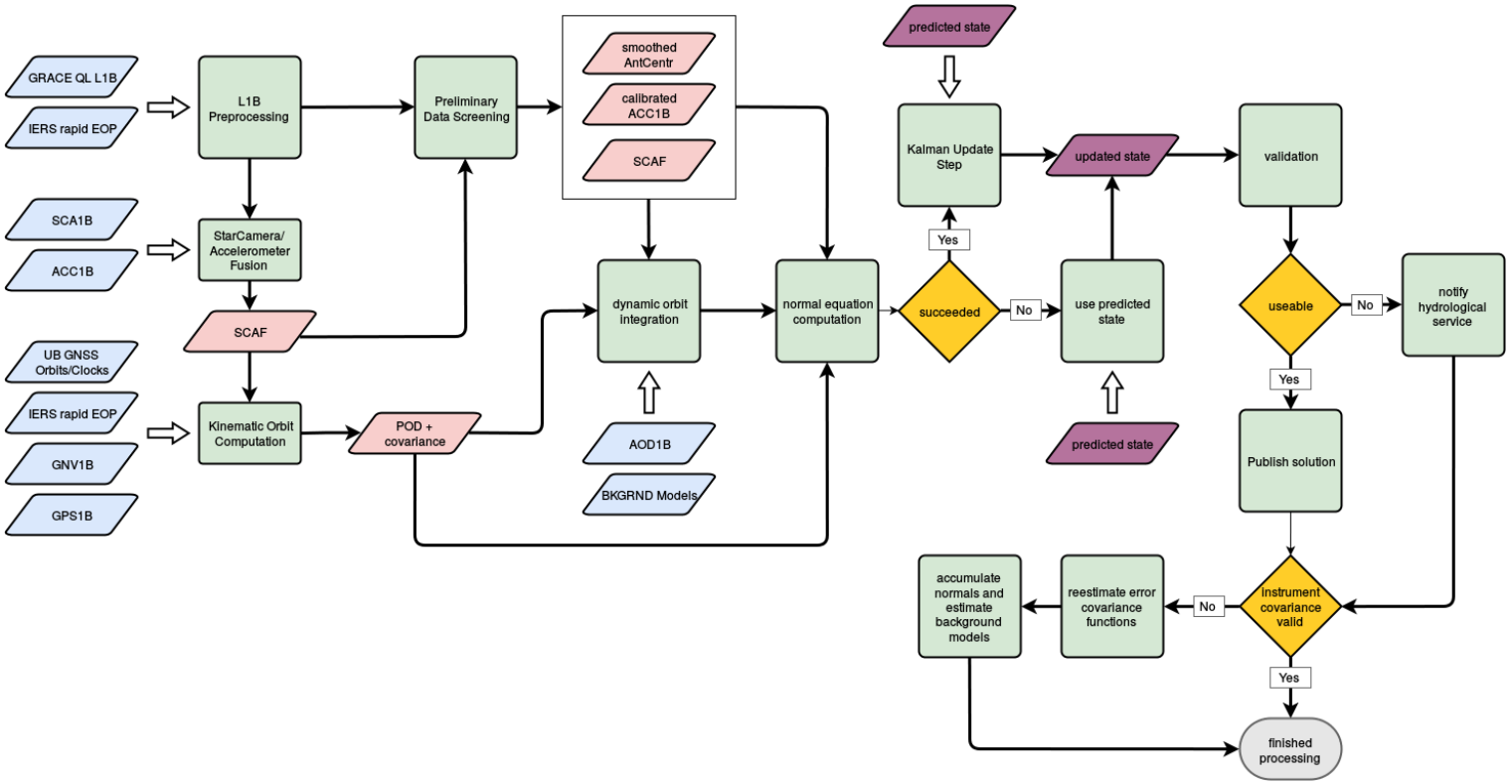
Wate
GRACE monthly solutions

Daily Kalman solutions

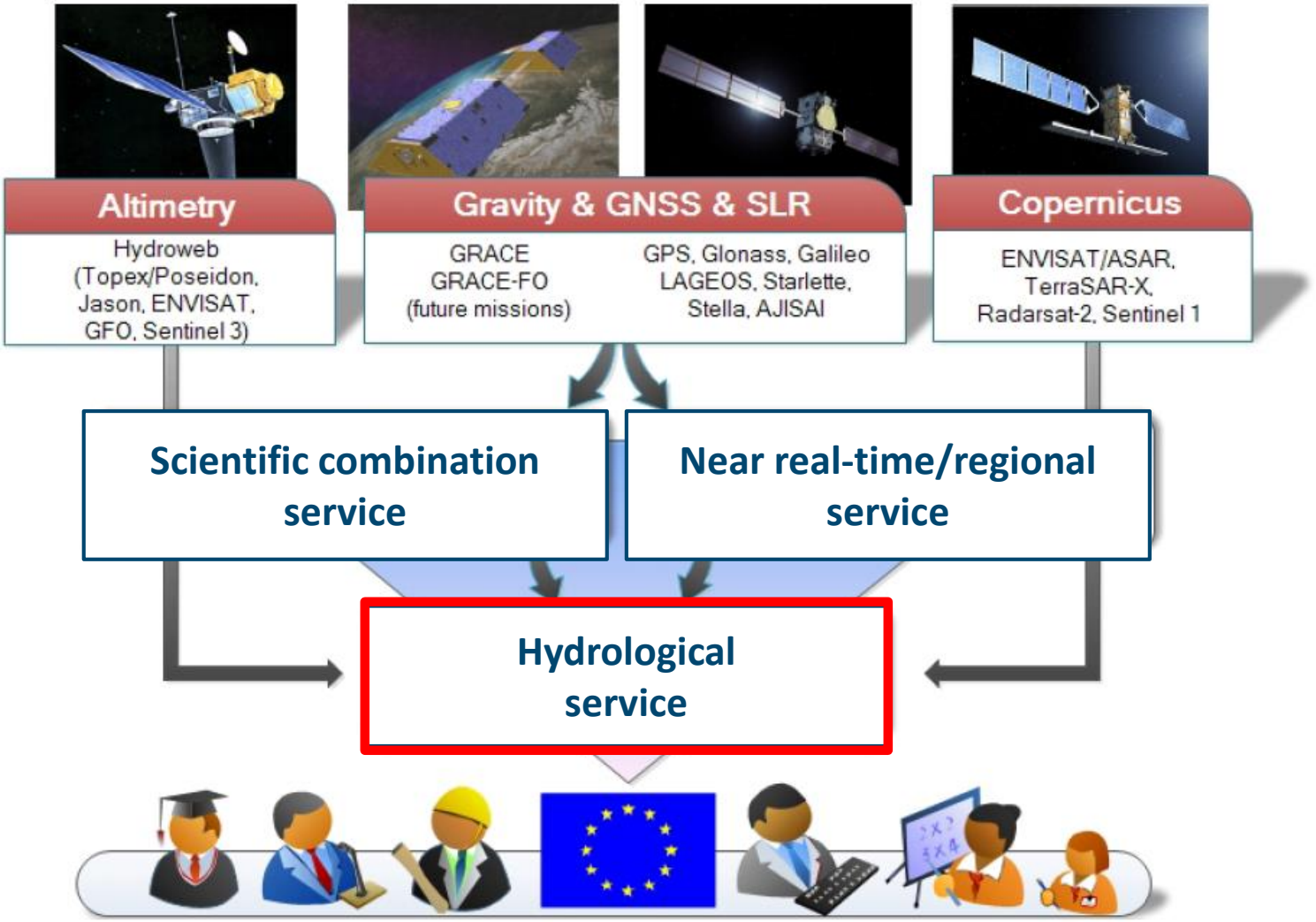


Near real time (max. 5 days delay)

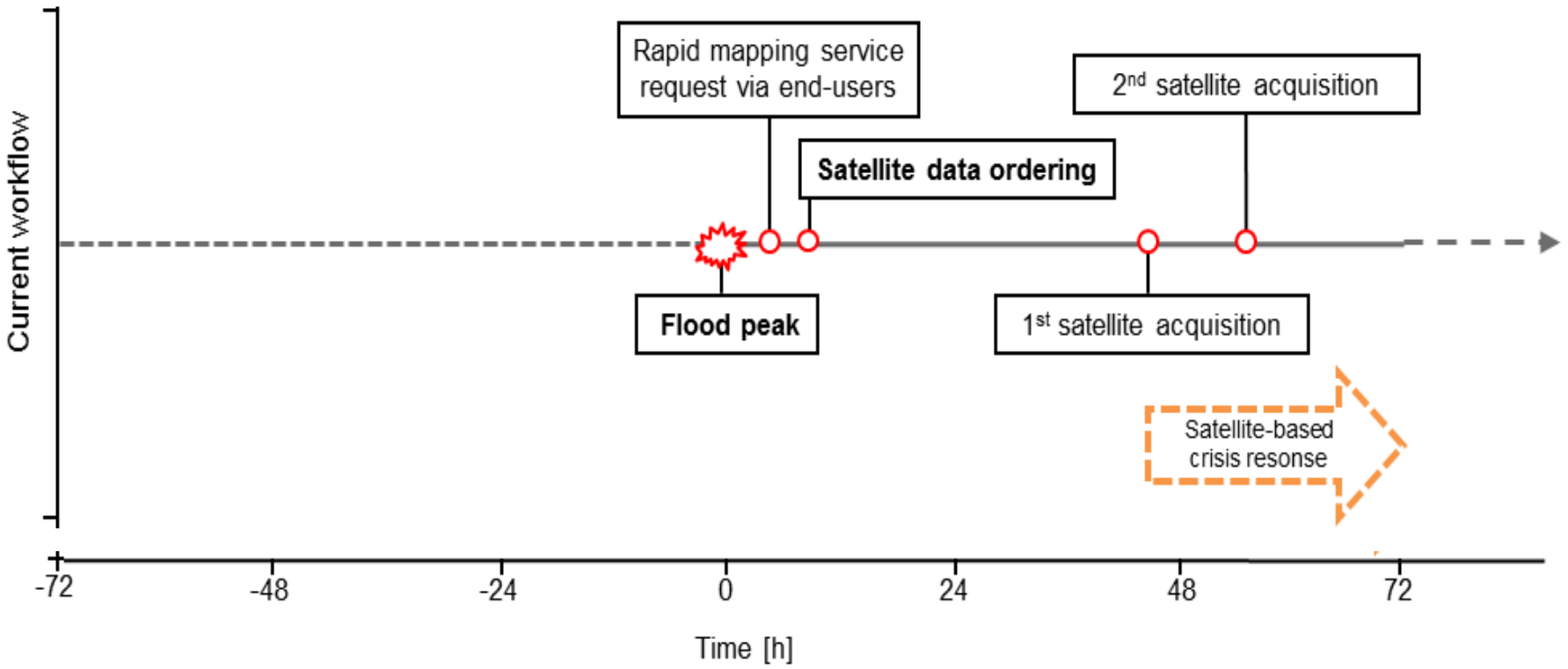
- Adapted daily gravity field processing scheme:
  - Rapid GNSS constellation and Earth orientation
  - forward only filtering → increased high frequency noise



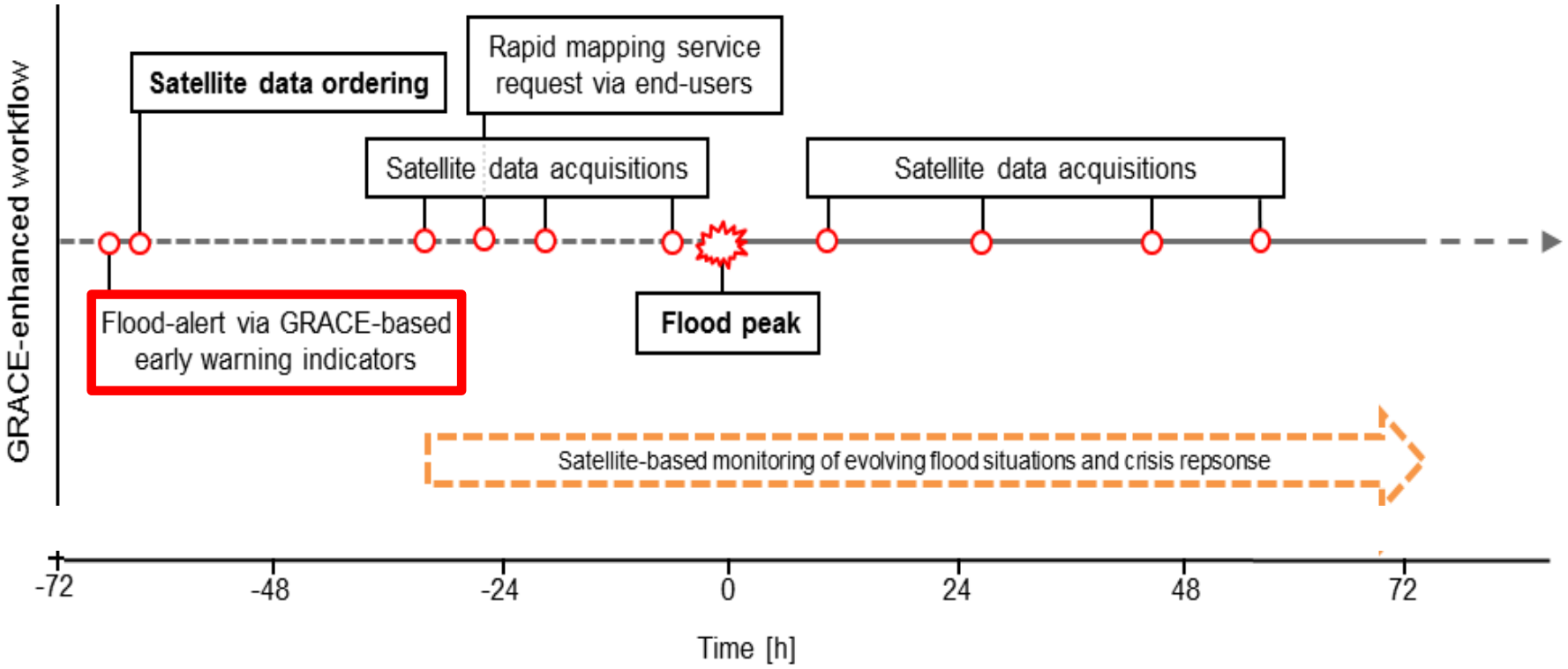
EGSIEM Project



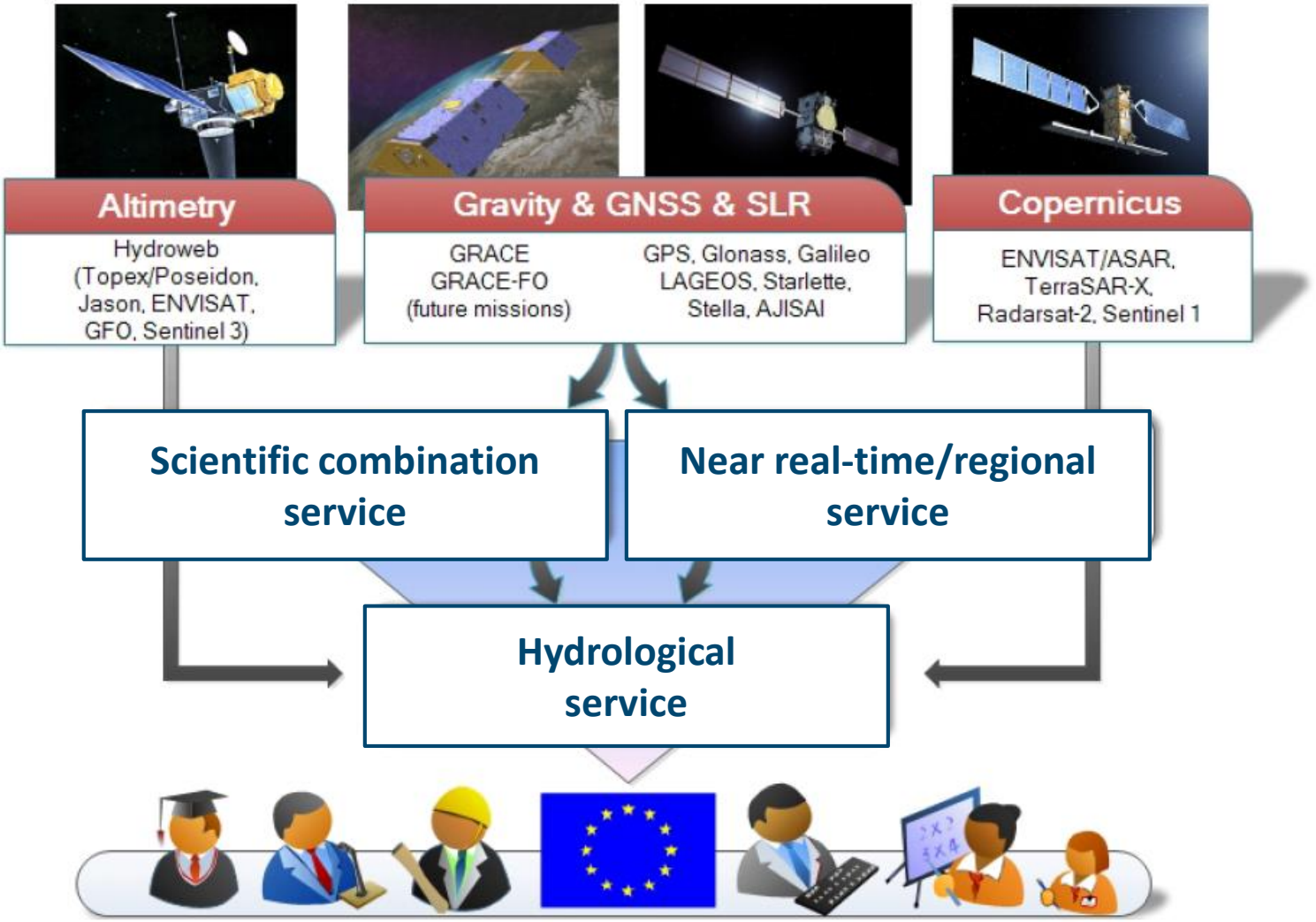
Integration into automatic flood emergency management services



Integration into automatic flood emergency management services



Summary (1/2)


Altimetry
Hydroweb
(Topex/Poseidon,
Jason, ENVISAT,
GFO, Sentinel 3)
Gravity & GNSS & SLR
GRACE
GRACE-FO
(future missions)
GPS, Glonass, Galileo
LAGEOS, Starlette,
Stella, AJISAI
Copernicus
ENVISAT/ASAR,
TerraSAR-X,
Radarsat-2, Sentinel 1
Scientific combination service
Near real-time/regional service
Hydrological service

Summary (2/2)

- Much effort is going on

Summary (2/2)

- Much effort is g

Poster X3.35
Ulrich Meyer et al.:
EGSIEM: Combination of GRACE monthly gravity models on normal equation level

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Keep in touch

Newsletter

No. 1
April 2015

EGSIEM

European Gravity Service for Improved Emergency Management

Inside this issue:

Courtesy NASA/JPL Caltech

WELCOME TO EGSIEM

The **European Gravity Service for Improved Emergency Management (EGSIEM)** project, which is funded by the Horizon2020 Framework Program for Research and Innovation of the European Union, aims at using gravity field analysis for forecasting and mapping of hydrological extremes like large-scale droughts and flood events. The project is funded for three years, from 2015 to 2017. The leader of the project is the Astronomical Institute of the University of Bern.

EGSIEM CONSORTIUM

- **Universität Bern**, Switzerland
- **Université du Luxembourg**, Luxembourg
- **Helmholtz-Zentrum Potsdam Deutsches GeoForschungsZentrum**, Germany
- **Technische Universität Graz**, Austria
- **Leibniz Universität Hannover**, Germany
- **Centre National d'Études Spatiales**, France
- **Deutsches Zentrum für Luft- und Raumfahrt e.V.**, Germany
- **Géode & Cie**, France

Photo: M.Tognola
EGSIEM kick-off meeting, 13.-14.January 2015, Bern

Goals and Ambitions

At the heart of the EGSIEM project is the idea that *better knowledge yields better decision-making*. Towards this idea the 8 consortium members of EGSIEM aim to derive improved products from the **Gravity Recovery and Climate Experiment** (GRACE) satellite mission. The current latency and complex nature of the data derived from the GRACE mission (a dual satellite mission of NASA and the German Aerospace Center, which has been making detailed measurements of Earth's gravity field variations since March 2002) makes the data of limited value for monitoring and forecasting applications. Currently Geodesists need to wait approximately 2 months from observation by GRACE until the data is processed for access and examination. EGSIEM will improve the data latency, will perform the complex processing, and will provide a simple to use web interface (based on the ***EGSIEM plotter*** provided by Géode & Cie). The data will be freely available for users.

The impact of EGSIEM

The main goal of the project is to improve the availability of data for users, especially in terms of better drought and flood forecasting. EGSIEM will reduce the timeframe to 5 days. As the data is going to be made freely available (via our project website egsiem.eu), the users may use them also for other applications as well. EGSIEM aims to improve existing monitoring products. The improvement in flood and drought monitoring will benefit Europe and also other countries. For example the impact of the 2009 flood in Namibia which claimed 131 lives and displaced 445,000 people could have been better anticipated by the existence of concise warning products.

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News and updates will be regularly published on various media, e.g., by the quarterly EGSIEM Newsletter.
www.egsiem.eu

EGSIEM is also present on social media:
https://twitter.com/EGSIEM
www.facebook.com/egsiem
https://egsiem.wordpress.com

EOSIEM

European Gravity Service for Improved Emergency Management

This project is funded by the Horizon 2020 Framework Programme of the European Union under grant agreement No 637010.

Graz University of Technology

Horizon2020